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ABSTRACT

This research describes the statistics and interpretations currently used for reporting discriminant analysis results and attempts to provide some approximate guidelines. Articles in the last 10 years of the American Educational Research Journal (AERT) were scanned. Eighteen studies containing 86 different discriminant analyses were identified and reviewed. There were not enough analyses to advocate a guideline for the overall percent of correct classifications (PCC). The mean canonical correlation for the first discriminant fuction was .34 and the median correlation was .32 (n=67). Appendices contain: (1) frequency data and distributions on selected issues; and (2) an 18-item bibliography of the studies used in the meta-analysis. (Author/BS)

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A Mini-Meta-Analysis on the Use of Discriminant Analysis in Education

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presented to the

American Educational Research Association

New Orleans

April 23, 1984

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ABSTRACT
W.L. CURLETTE

The purpose of this research is to describe the statistics and interpretations currently used for reporting discriminant analysis results. In addition, an initial estimate is given for the typical value of the first canonical correlation in discriminant analysis. Because statistical methods can aid the summarization of the use of discrimiant analysis in the American Educational Research Journal (AERJ), the meta-analysis approach is justified. As far as can be determined, there is no article or paper which provides a quantitative summarization of these issues in discriminant analysis.

A Mini-Meta-Analysis on the Use of Discriminant Analysis in Education

The purpose of this research is to provide some approximate guidelines for interpreting discriminant analysis. In particular, an initial attempt is made to establish typical values for the overall percent of correct classifications (PCC) and the first canonical correlation in discriminant analysis. This study also describes the statistics and interpretations currently employed for reporting discriminant analysis results. As far as can be determined, there is no article or paper which provides a quantitative summarization of these issues in discriminant analysis.

Initially, it was planned to use Educational Resources Information Center (ERIC) descriptors to locate studies. However, a search using the ERIC descriptors of classification intersected with statistical analysis resulted in many studies being retreived which did not contain empirical data or the usual statistical classification techniques. Furthermore, some journals were difficult to obtain. Consequently, to clearly define the population of articles and to have a manageable task, this study was limited articles published during the last ten years in the American Educational Research Journal (AERJ). Because statistical methods can aid the summarization of the use of discriminant analysis in AERJ, the meta-analysis approach is justified.

Procedures

The last ten years of AERJ from volumn eleven number one 1974 to volumn twenty number four 1983 were searched by scanning each article for discriminant analysis. Discriminant analysis was considered to be the use of canonical variates to describe differences among groups or predict group membership as presented in Anderson (1958) or Tatsuoka (1971). Oneway multivariate analysis of variance articles where only a test statistic such as Wilks' Lambda was reported and no discriminant functions were discussed were not included.

The questions or isssues used in the meta-analysis to describe the discriminant analysis studies are given in Appendixes 1 and 2. In a few articles, a series of discriminant analyses were referred to being conducted but no results were reported. These passing references to discriminant analysis were not included in the meta-analysis.

Of the various criticisms that have been leveled at meta-analysis, the problem of "Lumpy (Nonindependent) Data" may be the most serious (Glass, McGraw & Smith, 1981). The data are lumpy in the sense of study differences such as sample sizes and outcome measures. The data are typically nonindependent because meta-analysis often addresses questions which have the effect of allowing some studies to contribute more than on outcome measure.

Using Smith and Glass' original meta-analysis as an illustration, Landman and Dawes (1982) discuss five sources which contribute to results being dependent: a) "multiple measures

from the same subjects..."; b) "measures taken at multiple points in time from the same subjects"; c) "Nonindependence of scores within a single outcome measure", where both a subtest and a global score containing the subtest are treated as outcome measures; d) "Nonindependence of studies within a single article", where two different studies using some of the same subjects are reported in an article; and e) "Nonindependent samples across studies", where two different studies using at least some of the same subjects are reported in different articles (pp. 506-507). Several methods have been suggested for reducing or eliminating the first two sources of dependency (e.g., Kulik, Kulik & Cohen, 1979a, 1979b; Cooper, 1979; Walberg and Haertel, 1980; Glass, McGraw and Smith, 1981). Despite these approaches, Landman and Dawes (1982), in a partial reanalysis of Smith and Glass' (1977) meta-analysis, found that the first two sources of dependency did not appreciably affect the estimated magnitude of effect. In the summary on discriminant analysis, the unit of analysis is the individual discriminant function, although some results are reported by article.

Results

Eighteen studies were found employing discriminant analysis containing a total of eighty six different discriminant analyses. The number of research reports listed as "articles" in AERJ during the ten years is 320. Descriptive statistics for each of the questions or issues in the meta-analysis are presented in Appendices 1 and 2.

A Guideline for Interpreting Discriminant Analysis

The first canonical correlation squared times one-hundred may be thought of as the percentage of variability accounting for group membership in the discriminant scores on the first discriminant function. The mean canonical correlation for the first discriminant function was .34 and the median correlation was .32 (n=67). Thus, as a typical value only approximately nine percent of the variablility in the first discriminant function is associated with group membership.

There were not enough articles or analyses to advocate a guideline for PCC. Three articles containing 10.5% of the analyses formed extreme groups by omitting people who were not extreme on an underlying continuous variable used to define populations. For example, two extreme groups might be the best students and the worst students at a particular college. Two of the three articles reported PCC's. The mean PCC was 95.9% with one analysis resulting in 100% (n=4). There were three studies having two groups which were not extreme groups and reporting PCC's. The mean PCC was 69.7% and the median was 70.0% (n=11).

In all analyses the apparent procedure used to obtain PCC's was to classify the same data set used to form the discriminant functions. No reference was made in any article to the jacknife or leave-one-out technique. With only a couple of exceptions, there was no indication of any "new" data being collected for use in the discriminant functions. Thus, from the viewpoint of

the method used to estimate the PCC's, the previous summary PCC's are likely to be overestimates of the true PCC's.

Summary of Procedures Used in Discriminant Analysis

The regression approach to two group discriminant analysis. Scanning through each of the forty journals resulted in locating articles which would probably not be indexed under classification or discriminant analysis in ERIC. For example, four articles were located where the primary analysis was multiple regression with a dichotomous criterion variable. These articles contained forty analyses.

It is well known that ordinary least squares (OLS) regression does provide a linear function proportional to the function obtained from maximizing the discriminant criterion. However, the questions addressed in regression are traditionally somewhat different than those asked in discriminant analysis. The four regression studies are characterized as follows: a) none employed variable reduction to obtain a reduced model, b) results were not interpreted in terms of differences between group centroids, c) none used classification, d) all studies interpreted regression coefficients, and e) 95% of the analyses included means of predictor variables.

Interpreting a discriminant function. One way to interpret a discriminant function is to compare the discriminant function weights as an indication of the relative importance of the corresponding variables for describing group differences. Various authors (e.g., Timm, 1975; Tatsuoka, 1973a) have expressed

reservations concerning interpreting discriminant function weights because the correlations among the variables influence the coefficients' magnitudes. Nevertheless, interpreting discriminant function weights was often employed (68.6% of the analyses).

In one of the articles (Kohen, Nestel & Karmas, 1978), the authors desired to use a log linear model for a two group classification problem but did not have an appropriate computer program available. They used OLS multiple regression and incorrectly interpreted the differences between weights as probabilities.

An alternative method for interpreting discriminant functions is to examine the Pearson correlations between the discriminant scores and each of the variables in the function (structure correlations) or other variables measured on the same subjects. This approach was used once in the eighteen articles.

Full and Reduced Models. In 81.4% of the analyses full models were interpreted and variable reduction to obtain a reduced model was not attempted. In some articles, full models were reported with some variables in the models not statistically significant, nevertheless the discriminant coefficients were interpreted. The most frequent method to obtain reduced models was an F-to-enter of one or more in a stepwise discriminant analysis.

Other Issues. Two methodological weaknesses found in more than one article were the lack of means and variances being reported on response variables in discriminant functions and ambiguous group definitions. In fact, only 55.8% of the analyses had means of response variables by group and 19.8% provided standard deviations (or variances). Three studies used researcher selection, teacher selection, or subject self selection to define group membership for a person, thus generalizing the results to other situations may be difficult. Other methodological problems occurring only once in the eighteen articles were using uncorrected omega squared (for correction see Tatsuoka, 1973b) and using numbers 1 through 4 rather than dummy coding for categorical variables.

Discussion

The mean canonical correlation for 67 analyses is .34 (standard deviation is .128) and the median is .32. Of course, these results are limited due to surveying only AERJ articles and including studies containing more than one discriminant analysis. In reviewing the eighteen articles, there were opportunties to improve the conducting and interpreting of discriminant analysis which were not taken. These include: a) using the leave-one-out technique to estimate PCC's, b) using structure correlations to help "name" discriminant functions, c) reporting means and variances of response variables, d) discussion of prior probabilities, e) numerical approaches to interpret the PCC's, f) more discussion of variable reduction

procedures, and g) better group definitions. It is hoped that more discussion of these issues and more sophisticated computer programs will ameliorate the use of discriminant analysis.

References

Anderson, T. W. (1958). An introduction to multivariate statistical analysis. New York: John Wiley & Sons.

Cooper, H. M. (1979). Statistically combining independent studies: A meta-analysis of sex differences in conformity research. Journal of Personality and Social Psychology, 37, 131-145.

Glass, G. V, McGaw, B. & Smith, M. L. (1981). Meta-analysis in social research. Beverly Hills: Sage Publications.

Kulik, J. A., Kulik, C. C., & Cohen, P. A. (1979a). A meta-analysis of outcome studies of Keller's personalized system of instruction. American Psychologist, 34, 307-318.

Kulik, J. A., Kulik, C. C., & Cohen, P. A. (1979b). Research on auto-tutorial instruction: A meta-analysis of comparative studies. Research in Higher Education. 11, 321-341.

Landman, J. T., & Dawes, R. M. (1982). Psychotherapy outcome: Smith and Glass' conclusions stand up under scrutiny. American Psychologist, 37, 504-516.

Smith, M L. & Glass, G. V (1977). Meta-analysis of psychotherapy outcome studies. American Psychologist, 32, 752-760.

Tatsuoka, M. M. (1971). Multivariate analysis: Techniques for educational and psychological research. New York: Wiley.

Tatsuoka, M. M. (1973a). Multivariate analysis in educational research. In F. N. Kerlinger (Ed.), Review of research in education. Peacock.

Tatsuoka, M. M. (1973b). An examination of the statistical properties of a multivariate measure of strength of relationship. Final report of Project No. 2-E-020, Grant No. OEG-5-72-0027 (509). Submitted to the Department of Health, Education, and Welfare, December, 1973.

Timm, N. H. (1975). Multivariate analysis with applications in education and psychology, Monterey: Brooks/Cole.

Walberg, H. J. & Haertel, E. H. (1980). Research integration: An introduction and overview. Evaluation in Education, 4, 5-10.

Appendix 1

Frequency Data on Selected Meta-Analysis Questions or Issues

Questions or Issues	Frequency*
1. Number of Groups	
2 Groups	73
More Than 2 Groups	11
2. Group Formation	
Natural Groups	80
Researcher Randomly Assigns	1
3. Are extreme groups employed?	
Yes	9
No	53
4. Are discriminant function coefficients interpreted?	
Yes	59
No	25
5. Are means of response variables reported in each group?	
Yes	48
No	38
6. Are variances of response variables reported in each group?	
Yes	17
No	69

* The difference between the sum of the frequencies for any category and 86 is due to missing data.

Appendix 1 Continued

Questions or Issues	Frequency
7. Are structure coefficients reported?	
Yes	2
No	84
8. Are univariate ANOVA F's reported?	
Yes	11
No	74
9. Is statistical classification employed?	
Yes	18
No	68
10. Were prior probabilities used?	
Yes	9
No or not stated	9
11. Were prior probabilities proportional to group sample sizes?	
Yes	0
No	9
12. Were costs of misclassification specified?	
Yes	0
No	18

Appendix 1 Continued

Questions or Issues	Frequencies
13. Which procedure was used to estimate PCC's?	
Classified calibration sample	8
"New" validation sample	0
Jacknife	0
Double-cross validation	0
14. Were numerical baselines used to help interpret PCC's?	
Yes	7
No	11
15. Were PCC's reported?	
Yes	16
No	2

Appendix 2

Frequency Distributions for Selected Meta-analysis Issues

PERCENT PCC

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	37.	1	1.2	6.3	6.3
	52.	1	1.2	6.3	12.5
	59.	1	1.2	6.3	18.8
	65.	1	1.2	6.3	25.0
	67.	1	1.2	6.3	31.3
	69.	1	1.2	6.3	37.5
	70.	1	1.2	6.3	43.8
	71.	1	1.2	6.3	50.0
	74.	1	1.2	6.3	56.3
	75.	2	2.3	12.5	68.8
	91.	1	1.2	6.3	75.0
	92.	1	1.2	6.3	81.3
	3.	1	1.2	6.3	87.5
	[illegible]	1	1.2	6.3	93.8
	100.	1	1.2	6.3	100.0
	-1.	70	81.4	MISSING	100.0
	TOTAL	86	100.0	100.0	

MEAN	74.382	MEDIAN	71.350	MODE	75.000
STD DEV	17.410				
VALID CASES	16	MISSING CASES	70		

DRIGP NO. VAR. FULL MODEL

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	1.	2	2.3	2.5	2.5
	2.	3	3.5	3.7	6.2
	3.	1	1.2	1.2	7.4
	4.	4	4.7	4.9	12.3
	5.	2	2.3	2.5	14.8
	6.	1	1.2	1.2	16.0
	7.	1	1.2	1.2	17.3
	8.	3	3.5	3.7	21.0
	9.	2	2.3	2.5	23.5
	10.	15	17.4	18.5	42.0
	11.	17	19.8	21.0	63.0
	12.	15	17.4	18.5	81.5
	13.	1	1.2	1.2	82.7
	14.	1	1.2	1.2	84.0
	18.	2	2.3	2.5	86.4
	20.	5	5.8	6.2	92.6
	21.	6	7.0	7.4	100.0
	-1.	5	5.8	MISSING	100.0
	TOTAL	86	100.0	100.0	

MEAN	11.086	MEDIAN	10.882	MODE	11.000
STD DEV	4.985				
VALID CASES	81	MISSING CASES	5		

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REDP NO. VAR. REDUCED MODEL

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	1.	1	1.2	10.0	10.0
	4.	1	1.2	10.0	20.0
	5.	1	1.2	10.0	30.0
	6.	1	1.2	10.0	40.0
	8.	1	1.2	10.0	50.0
	9.	3	3.6	30.0	80.0
	10.	1	1.2	10.0	90.0
	12.	1	1.2	10.0	100.0
	-1.	78	88.4	MISSING	100.0
	TOTAL	88	100.0	100.0	

MEAN 7.300 MEDIAN 8.500 MODE 9.000
STD DEV 3.268
VALID CASES 10 MISSING CASES 78

REDPRO VAR. REDUCTION TECH.

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	2.	3	3.6	30.0	30.0
	5.	7	8.1	70.0	100.0
	-1.	78	88.4	MISSING	100.0
	TOTAL	88	100.0	100.0	

MEAN 4.100 MEDIAN 4.357 MODE 5.000
STD DEV 1.449
VALID CASES 10 MISSING CASES 78

Codes:
2 - Stepwise without further specification
5 - Stepwise with F to include greater than or equal to 1

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CANC1 CANONICAL CORR1

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	0.06	1	1.2	1.5	1.5
	0.11	1	1.2	1.5	3.0
	0.16	1	1.2	1.5	4.5
	0.17	1	1.2	1.5	6.0
	0.20	1	1.2	1.5	7.5
	0.24	1	1.2	1.5	9.0
	0.26	2	2.3	3.0	11.9
	0.28	3	3.5	4.5	16.4
	0.29	1	1.2	1.5	17.9
	0.30	12	14.0	17.9	35.8
	0.31	8	9.3	11.9	47.8
	0.32	3	3.5	4.5	52.2
	0.33	3	3.5	4.5	56.7
	0.34	5	5.8	7.5	64.2
	0.35	6	7.0	9.0	73.1
	0.36	4	4.7	6.0	79.1
	0.37	3	3.5	4.5	83.6
	0.38	1	1.2	1.5	85.1
	0.41	3	3.5	4.5	89.6
	0.43	2	2.3	3.0	92.5
	0.45	1	1.2	1.5	94.0
	0.49	1	1.2	1.5	95.5
	0.82	1	1.2	1.5	97.0
	0.83	1	1.2	1.5	98.5
	0.86	1	1.2	1.5	100.0
	-1.	19	22.1	MISSING	100.0
	TOTAL	86	100.0	100.0	

MEAN	0.342	MEDIAN	0.320	MODE	0.300
STD DEV	0.128				

VALID CASES 67 MISSING CASES 19

NUMBER NUMBER OF OBSERVATIONS

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	31.	1	1.2	1.2	1.2
	82.	1	1.2	1.2	2.5
	90.	1	1.2	1.2	3.7
	98.	1	1.2	1.2	5.0
	100.	2	2.3	2.5	7.5
	118.	1	1.2	1.2	8.7
	140.	1	1.2	1.2	10.0
	177.	1	1.2	1.2	11.2
	207.	9	10.5	11.2	22.5
	217.	2	2.3	2.5	25.0
	244.	1	1.2	1.2	26.2
	248.	1	1.2	1.2	27.5
	284.	1	1.2	1.2	28.7
	311.	1	1.2	1.2	30.0
	312.	1	1.2	1.2	31.2
	380.	1	1.2	1.2	32.5
	387.	1	1.2	1.2	33.7
	374.	1	1.2	1.2	35.0
	378.	1	1.2	1.2	36.2
	383.	8	9.3	10.0	46.2
	407.	1	1.2	1.2	47.5
	422.	1	1.2	1.2	48.7

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433.	1	1.2	1.2	50.0
437.	1	1.2	1.2	51.2
438.	1	1.2	1.2	52.5
467.	1	1.2	1.2	53.7
518.	1	1.2	1.2	55.0
545.	1	1.2	1.2	56.3
547.	1	1.2	1.2	57.5
580.	1	1.2	1.2	58.7
570.	1	1.2	1.2	60.0
687.	1	1.2	1.2	61.2
701.	1	1.2	1.2	62.5
718.	1	1.2	1.2	63.7
758.	1	1.2	1.2	65.0
805.	1	1.2	1.2	66.2
844.	1	1.2	1.2	67.5
897.	1	1.2	1.2	68.8
952.	1	1.2	1.2	70.0
995.	1	1.2	1.2	71.2
1029.	1	1.2	1.2	72.5
1048.	1	1.2	1.2	73.7
1092.	1	1.2	1.2	75.0
1099.	1	1.2	1.2	76.2
1332.	1	1.2	1.2	77.5
1378.	1	1.2	1.2	78.7
1804.	1	1.2	1.2	80.0
1880.	1	1.2	1.2	81.3

1986.	1	1.2	1.2	82.5
2326.	1	1.2	1.2	83.7
2444.	1	1.2	1.2	85.0
2897.	1	1.2	1.2	86.2
2779.	1	1.2	1.2	87.5
2995.	1	1.2	1.2	88.7
3092.	1	1.2	1.2	90.0
4539.	1	1.2	1.2	91.2
5986.	1	1.2	1.2	92.5
7125.	1	1.2	1.2	93.8
8279.	1	1.2	1.2	95.0
19285.	1	1.2	1.2	96.2
21125.	1	1.2	1.2	97.5
39157.	1	1.2	1.2	98.7
70421.	1	1.2	1.2	100.0
-1.	5	7.0	MISSING	100.0
TOTAL	75	100.0	100.0	

MEAN 2827.700 MEDIAN 413.500 MODE 207.000
STD DEV 9358.777

VALID CASES 80 MISSING CASES 5

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Appendix 3

Studies Used in Meta-Analysis

Bejar, I.I. & Doyle, K.O. (1978). Relationship of curriculum area and course format with student rating in instruction. American Educational Research Journal. 15(4), 483-487.

Benbow, C.P. & Stanley, J.C. (1982). Consequences in high school and college of sex differences in mathematical reasoning ability: a longitudinal perspective. American Educational Research Journal. 19(4), 598-622.

Centra, J.A. (1980). Graduate degree aspirations of ethnic student groups, American Educational Research Journal. 17(4), 459-478.

Chapman, D.W. & Hutcheson, S.M. (1982). Attrition from teaching careers: a discriminant analysis. American Educational Research Journal. 19(1), pp. 93-105.

Hackman, J.D. & Taber, T.D. (1979) Patterns of undergraduate performance related to success in college. American Educational Research Journal. 16(2), 117-138.

Hearn, J.C. & Moos, R.H. (1978). Subject matter and classroom climate: a test of Holland's environmental propositions. American Educational Research Journal. 15(1), 111-124.

Haller, E.J. & Davis, S.A. (1980). Does socioeconomic status bias the assignment of elementary school students to reading groups? American Educational Research Journal. 17(4), p. 409-418.

Kohen, A.I., Nestel,G. & Karmas, C. (1978). Factors affective individual persistence rates in undergraduate college programs. American Educational Research Journal. 15(2), p. 233-252.

Latta, M.R. (1978). Interactive effects of initial achievement orientation and prior success feedback on the mastery of subsequent difficult and easy tasks. American Educational Research Journal. 15(1), 17-24.

Marsh, H.W. (1977). The validity of students' evaluations: classroom evaluations of instructors independently nominated as best and worst teachers by graduating seniors. American Educational Research Journal. 14(4), 441-447.

Pascarella, E.T. & Chapman, D.W. (1983). A multiinstitutional, path analytic validation of Tinto's model of college withdrawal, American Educational Research Journal. 20(1), 87-102.

Peng, S.[illegible] & Fetters, W.B. (1978). Variables involved in withdrawal during the first two years of college: preliminary findings from the national longitudinal study of the high school class of 1972, American Educational Research Journal. 15(3), 36[illegible]-372.

Pettegrew, L.S. & Wolf, G.E. (1982). Validating measures of teacher stress, American Educational Research Journal. 19(3), pp. 373-396.

Randhawa, B.S. & Michoyluk, J.O. (1975). Learning environment in rural and urban classrooms. American Educational Research Journal. 12(3), 265-285.

Salili, F., Maehr, M.L., Sorensen, R.L. & Fyans, L.J., Jr. (1976). A further consideration on motivation, American Educational Research Journal. 13(2), 85-102.

Terenzini, P.T. & Paascarella, E.T. (1077). An assessment of the construct validity of the Clark-trow typology of college student subcultures. AmericanEducational Research Journal. 14(3), 225-298.

Thompson, S. (1980). Do individualized mastery and traditional instructional systems yield different course effects. American Educational Research Journal. 17(3), 361-375.

Willig, A.C., Harnisch, D.L., Hill, K.T. & Maehr, M.L. (1983). Sociocultural and educational correlates of Success-Failure attributions and evaluation anxiety in the school setting for Black, Hispanic, and Anglo children. American Educational Research Journal. 20(3), 385-410.

Appendix 2

Frequency Distributions for Selected Meta-analysis Issues

PERCENT PCC

CATEGORY LABEL	CODE	ABSOLUTE FREQ	RELATIVE FREQ (PCT)	ADJUSTED FREQ (PCT)	CUM FREQ (PCT)
	37.	1	1.2	6.3	6.3
	52.	1	1.2	6.3	12.5
	59.	1	1.2	6.3	18.8
	65.	1	1.2	6.3	25.0
	67.	1	1.2	6.3	31.3
	69.	1	1.2	6.3	37.5
	70.	1	1.2	6.3	43.8
	71.	1	1.2	6.3	50.0
	74.	1	1.2	6.3	56.3
	75.	2	2.3	12.5	68.8
	91.	1	1.2	6.3	75.0
	92.	1	1.2	6.3	81.3
	93.	1	1.2	6.3	87.5
	99.	1	1.2	6.3	93.8
	100.	1	1.2	6.3	100.0
	-1.	70	81.4	MISSING	100.0
	TOTAL	86	100.0	100.0	

MEAN	74.382	MEDIAN	71.350	MODE	75.000
STD DEV	17.410				
VALID CASES	16	MISSING CASES	70		

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